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document Deterministic and Highly Efficient Quantum Cryptography with Entangled Photon Pairs Zhi Zhao, Tao Yang, Zeng-Bing Chen, Jiangfeng Du, and Jian-Wei Pan Department of Modern Physics, University of Science and Technology of China, Hefei, Anhui 230027, People's Republic of China 03.67.Lx, 42.50.Ar

abstract We present a protocol for deterministic and highly efficient quantum cryptography with entangled photon pairs in a 4×4-dimentional Hilbert space. Two communicating parties, Alice and Bob first share a both polarization- and path-entangled photon pair, and then each performs a complete Bell-state measurement on their own photon in one of two complementary Bell-state bases. It is demonstrated that each measurement in which both Alice and Bob register a photon can build certain perfect correlation and generate 1.5 key bits on average. The security of our protocol is guaranteed by the non-cloning theorem.